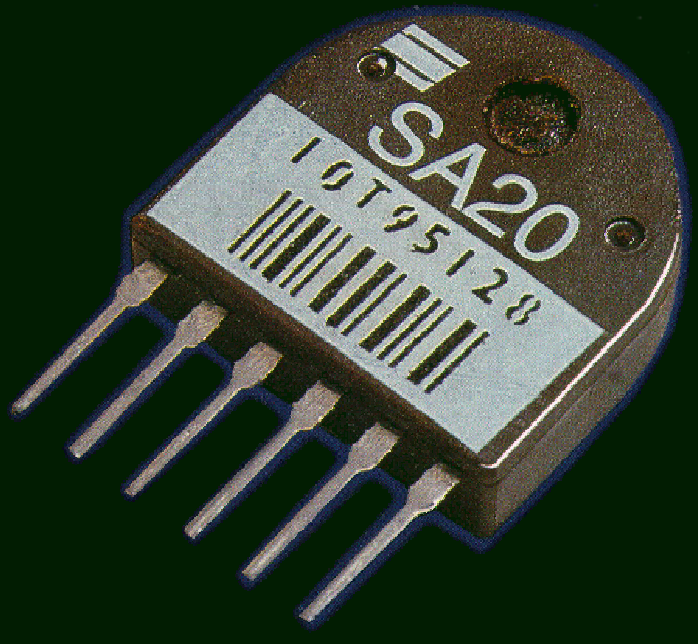
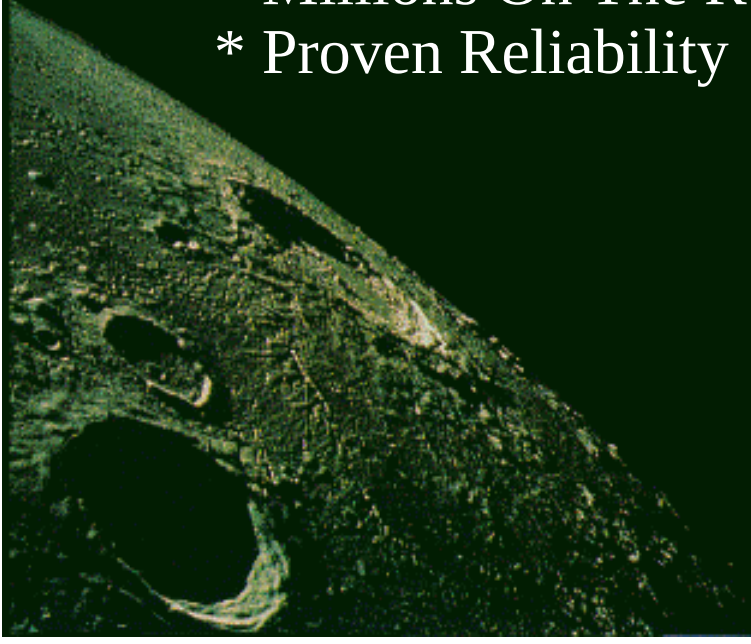
SA20

Crash Sensor



* Millions On The Road
* Proven Reliability



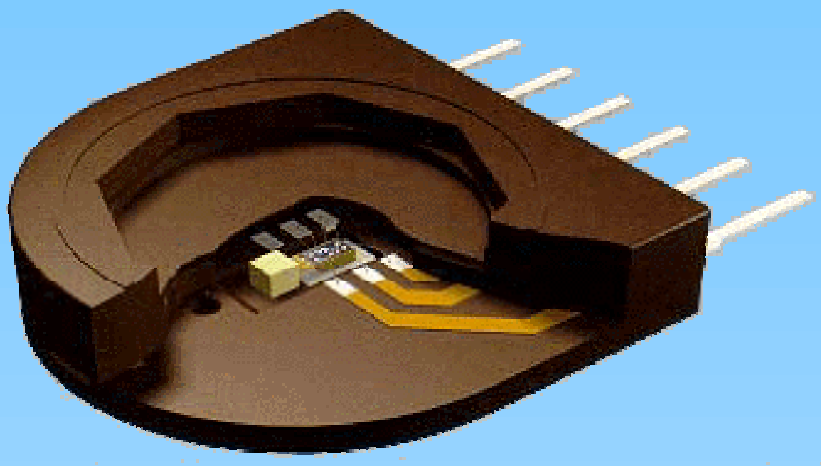
SensoNor

SA20 Crash Sensor

General
The SensoNor SA20 Crash Sensor is used by a number of air-bag system manufacturing companies and has made SensoNor the world's no. l independent manufacturer of electronic crash sensors. The SA20 represents SensoNor's 2. generation of crash sensors and is based on our experience since the mid 80ties as a crash sensor supplier.
We commit 100% to our customers goals regarding costs and reliability. In practice this means that SA20 is produced in a fully automated, high volume, purpose built production line.
A carefully developed control plan is utilized to safeguard the production.

Since the production start SA20 has been installed in millions of systems. During these years SA20 has proven its exceptionally good reliability. In addition, our work towards continuous improvement has paid off in improved yields and improved effectiveness. These facts in addition to the technical approach in utilizing well proven technology makes SA20 the first choice in crash sensing.

Application
SA20 is well suited for a range of system realizations. Due to a flexible production set-up a variety of pin configurations are possible; Ranging from a DIL concept for sensitive direction normal to the PCB, to a SIL concept meant for sensitive direction horizontal to the PCB, to special pin bending meant for surface mount. Since the SA20 includes a simple full bridge piezoresistive sensing element, it will be interfaced to a range of well proven signal conditioning interfacing circuits.



Interior View

An innovative concept of barcode marking the sensitivity onto the package of each individual sensor makes it easy to automatically calibrate the sensor during system assembly at our customers.

The excitation can be either voltage or current. By current excitation of a piezoresistive semiconductor strain gage a well known "intrinsic" temperature compensation can be achieved since the positive TCR of the bridge resistor compensate, for the negative TCS of the piezo resistivity.

A diagnostic resistor is covering the rim of the elastic element. Monitoring the electrical consistency of this resistor makes it possible at all times to verify the mechanical consistency of the device.

Concept
SA20 utilizes only a single (no sandwitch) very small

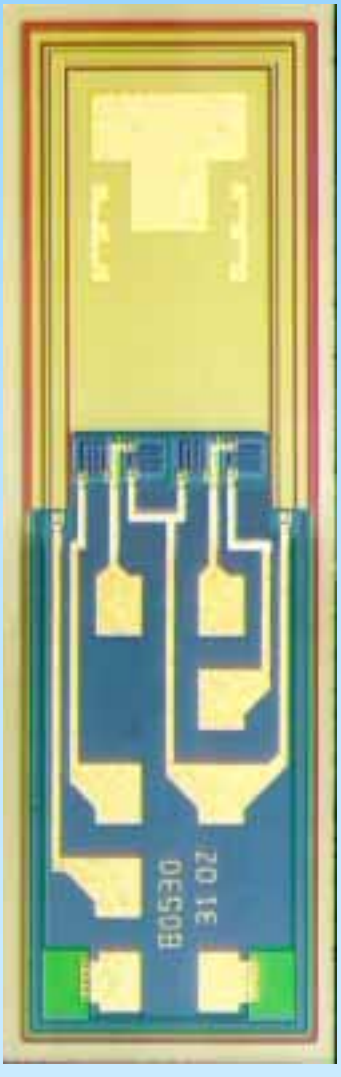
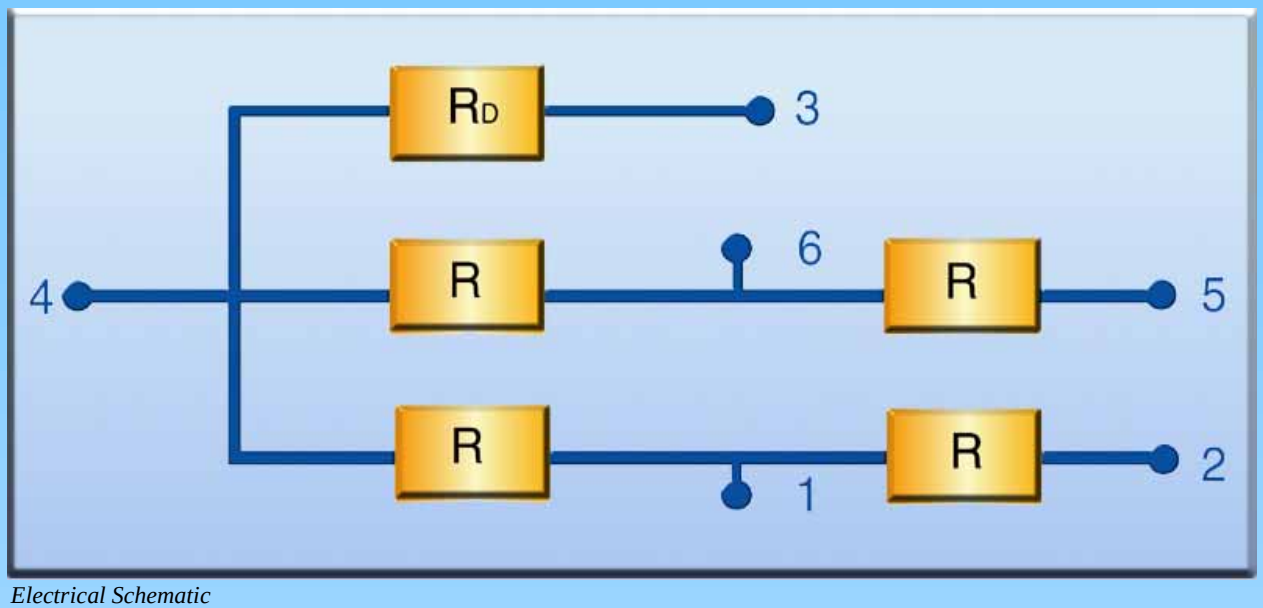


Photo of Cantilever Chip (50x magnified)

SA20 Crash Sensor



Electrical Schematic

(2.5mm times 0.9mm) single crystal silicon element. This element is directly forming a cantilever beam made possible by the combination of anisotropic etching and diamond saw dicing.

Onto the tip of the silicon beam a ceramic seismic mass is bonded using a slit design. The piezoresistive bridge consists of two transversal and two longitudinal piezoresistors located in the maximum stress region.

The sensing element is housed in a high reliability low cost welded PPS plastic housing. The inside compartment is filled with instrument grade silicone oil for controlled dynamic damping. As an integrated part of the housing a thinner plastic area acts as a diaphragm to equalize the inside pressure over the operational temperature range.

Reliability is optimized by avoiding mechanical overload stops which may cause internal fractures and by the moisture preventing surrounding silicone oil.
In addition a " buried"-resistor process makes the sensing resistors insensitive to surface effects like contamination.

Function
When exposed to an acceleration field the inertia of the seismic mass will cause the silicon beam to bend. The piezoresistors located near the surface of the beam will feel a high mechanical stress and they will change their value due to the piezoresistive effect in doped silicon. The change will be with opposite sign for the transversal and the longitudinal resistors, giving a full bridge output. Due to the full bridge design, zero-point shift as a function of temperature is low. The output signal. is directly ratiometric to the excitation signal.

The silicone oil viscosity is chosen to achieve critical damping at room temperature.

Cross axis sensitivity is low due to the ceramic mass which is symmetrically located as referred to the bending plane.

The output signal will have a good linearity even above +/-500g and it will be extremely linear in the specified range to +/-50g.

Transportation Packaging
SA20 is shipped in ESD proof plastic magazines in customized shape and length according to the mechanical pin configuration and customer specifications.

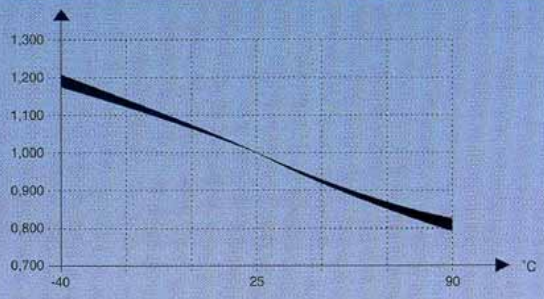
Magazine Package

SA20 Crash Sensor Specifications

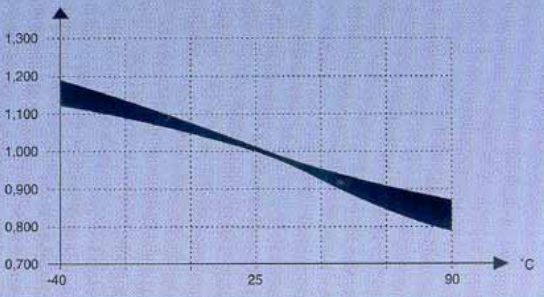
Input specifications				
Description	Min	Nom	Max	Units
Range	-50		50	g
Excitation voltage, recommended		5		V DC
Resistor value, bridge	4.1	5.5	6.9	kΩ
Resistor value, diagnostic	11.6	15.5	19.4	kΩ
Resistor matching		2	4	%
Output specifications (5V DC, +25˚C)				
Sensitivity at 63Hz	0.19	0.25	0.31	mV/g
Zero Balance	-60		60	mV
Nonlinearity			0.5	%FS
Hysteresis			0.2	%FS
Long term stability of sensitivity			3	%/10yrs
Cross-axis sensitivity			0.05	g/g
Noise (p-p) 0.3kHz			0.1	g
Dynamic performance (-40˚C to +90˚C)				
Undamped resonance frequency	2500			Hz
Frequency range, ±3dB	400			Hz
Damping ratio	0.1		2	---
Temperature effects (5V DC, +25˚C)				
TC bridge resistor	0.277	0.295	0.313	%/˚C
TC diagnostic resistor	0.244	0.260	0.276	%/˚C
Zero signal shift 25˚C to -40˚C			20	mV
25˚C to +90˚C			-15	mV
TC sensitivity at DC		-0.207		%/˚C
Maximum ratings				
Safe overload	-1500		1500	g
Temperature range, operational	-40		105	˚C
Temperature range, storage	-40		105	˚C
Excitation voltage			10	V DC or AC
Mechanical Shock			2000	g/1ms
Weight			1.5	gram

Sensitivity shift in reference to calibrated value

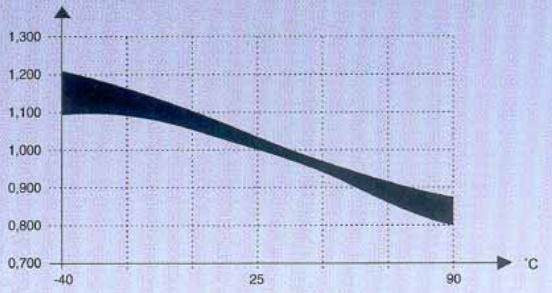
at 20Hz



at 150Hz

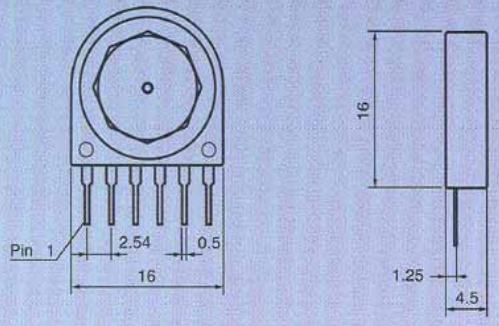


at 400Hz

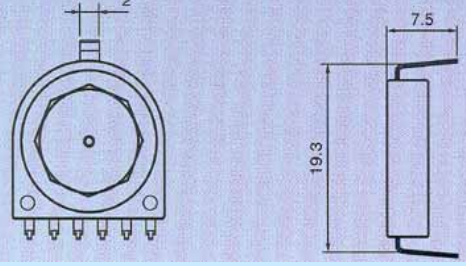


Mechanical dimensions in mm

SIL



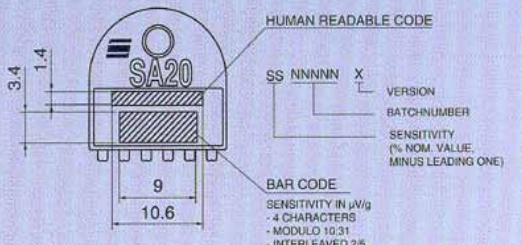
DIL



Pin configuration

Pin 1	- Signal
Pin 2	- Excitation
Pin 3	Diagnostic Resistor
Pin 4	+ Excitation & Substrate (N-type)
Pin 5	- Excitation
Pin 6	+ Signal

Marking



Specifications may be subject to alteration without prior notice.

SensoNor asa *P.O.Box 196. N-3192 Horten Norway, Tel: +47 33 03 50 00, Fax: +47 33 03 51 05*
E-mail sensonor@sensonor.no